Vol. 15 JULY, 1950 No. 7

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A WIDE-BAND INSTRUMENT AMPLIFIER

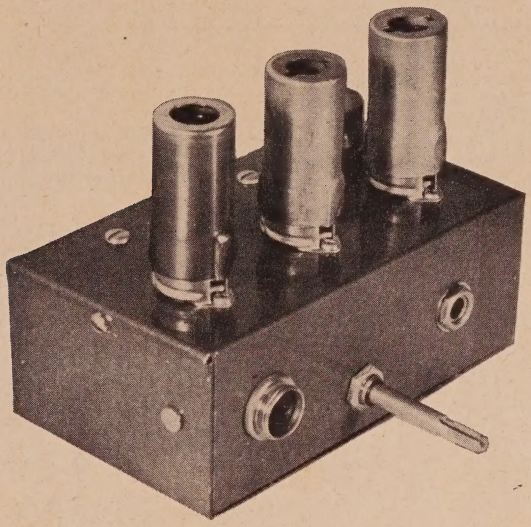

Fig. 1.

During the course of electronic tests and measurements, it frequently becomes necessary to check the value of low a. c. voltages, in both the audio-frequency and radio-frequency ranges, which are too small to be read on the most sensitive ordinary vacuum-tube voltmeter scale. These voltages usually are of the order of millivolts or several hundred microvolts.

In order to measure such voltages directly with an ordinary vacuum-tube voltmeter, it becomes necessary to employ a suitable high-gain amplifier between the meter and the source of unknown voltage. By this expedient, the small voltage is increased to a value easily readable on the meter scale. For the usual run of measurements confined solely to the a. f. spectrum, a conventional high-gain audio amplifier will suffice. In order to be most useful for general testing, however, an instrument amplifier must have reasonably flat response from a few cycles per second to several megacycles. Such wideband response makes measurements possible all the way from the power-line frequencies to the near short-wave-lengths with small error.

The instrument amplifier described in this article has been designed expressly for use ahead of a conventional a. c. vacuum-tube voltmeter having a 0-1- or 0-3-volt scale. An examination of the circuit diagram, Figure 2, shows this amplifier to be of standard video design. An overall maximum gain of 500 is provided. Response of the amplifier does not deviate more than 1½ db. from 50 cycles to 4 megacycles.

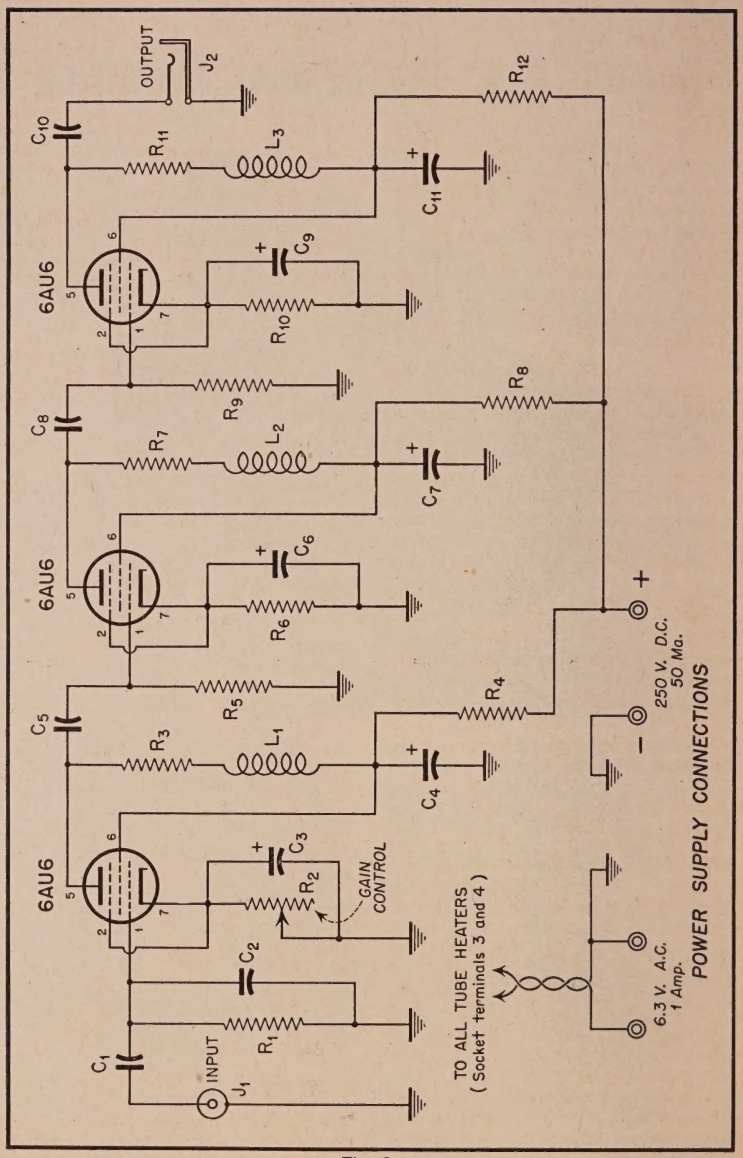
OUTPUT
J2
C10
R11
L3
R12
C11
6AU6
C9
R10
C8
R9
R8
R7
L2
C7
6AU6
C6
R6
C5
R5
R4
R3
L1
C4
6AU6
C3
R2
GAIN CONTROL
C2
C1
R1
INPUT
J1
TO ALL TUBE HEATERS
(Socket terminals 3 and 4)
6.3 V. A.C.
1 Amp.
250 V. D.C.
50 Ma.
POWER SUPPLY CONNECTIONS

Fig. 2.

The circuit is simple and one which may be utilized without difficulty by a builder having no advanced technical experience. It will be observed that the only important points of difference between this unit and a conventional resistance-capacitance-coupled audio amplifier are the low plate resistances (R_3, R_7, and R_{11}), the low-value cathode resistors (R_2, R_6, and R_{10}), and the series peaking coils (L_1, L_2, and L_3). A capacitor, C_2, is connected in parallel with the input grid resistor, R_1, to provide a reactance compensator in conjunction with the input coupling capacitor, C_1.

The input signal voltage is fed into the amplifier through a coaxial jack, J_1, and the amplified output signal is delivered by a phone-type jack, J_2, into which a plug connected to the v. t. voltmeter is inserted. A gain control, R_2, is provided in the cathode circuit of the first tube, and this control may be calibrated as will be shown under the subheading "Adjustment" on Page 6.

Three miniature high-transconductance tubes are employed in the simple lineup. The use of miniature tubes keeps the amplifier small and compact. The entire amplifier is built on a metal box-type chassis; 5¼" long, 3" wide, and 2" high. Various constructional details are discussed separately in the following paragraphs.

Peaking Coils.

The coils (L_1, L_2, and L_3) may be wound easily by hand. Each consists of 52 turns of No. 31 enamelled wire closewound on a ½-inch-diameter bakelite or polystyrene form. The length of the coil winding is ½ inch, and the coil inductance is approximately 24 microhenries. Every attempt should be made to keep these three coils identical. The coils must be wound tightly but it will not be necessary to dope them with cement. They should be mounted under the chassis as far apart as practicable and at right angles to each other, to prevent magnetic coupling.

Resistors.

The plate load resistors (R_3, R_7, and R_{11}) and the cathode resistors (R_2, R_6, and R_{10}) have lower values than are customarily encountered in resistance-capacitance-coupled amplifiers. This feature is characteristic of all video-type circuits. The resistors have standard catalogue values.

Resistors R_4, R_8, and R_{12} act in conjunction with capacitors C_4, C_7, and C_{11} to form decoupling filters which act to prevent undesired interaction between stages and attendant motorboating.

All resistors are of the 1-watt carbon type, except R_2 which is a wire-wound volume control-type potentiometer.

Capacitors.

Coupling capacitors C_1, C_5, C_8, and C_{10} are of the 400-volt tubular type and preferably should be non-inductive to prevent distortion of the flat response curve of the amplifier. C_2 is a miniature silvered mica unit. C_3, C_4, C_6, C_7, C_9, and C_{11} are miniature tubular electrolytics. Observe carefully the capacitor voltage ratings given in Figure 2.

Shielding and Isolation.

While it is advisable, in wiring the amplifier, to keep all wiring as well separated as practicable, we found no need for shielding any of the leads inside the instrument. It is recommended, however, that external signal leads to input and output plugs of the amplifier be shielded.

The peaking coils need not be shielded if they are mounted at right angles to each other and are separated as widely as possible. The coils should be mounted as close as practicable to the plate terminal of each corresponding tube socket, in order to insure the shortest possible leads.

All tube heater leads must be twisted tightly together in a pair and run flatly against the chassis via the shortest and most direct route between sockets. It is a good idea to wire-in

the heaters first, before attempting any other wiring, to insure their closeness to the chassis. Soldering lugs screwed to the chassis may be employed as miniature clamps to hold these heater leads firmly against the chassis. One side of each heater is grounded to the chassis at each tube socket (ground the No. 3 contact), to prevent hum.

The tubes must be mounted in miniature shields, as shown in the photograph. A wideband amplifier is very susceptible to hum pickup, especially in the input stage, and the tube shields aid materially in preventing this nuisance.

The B-plus, B-minus, and twisted heater leads may be brought out into a 4-wire power cable passed through a clearance hole in the rear of the chassis.

The amplifier may be mounted inside a smal metal box or cabinet together with its power supply, if a single packaged unit is desired, or it may be of the "open-chassis" type as shown in the photograph.

Power Supply.

It is urged strongly that a separate power supply be used, rather than a power unit built upon the same chassis as the amplifier. This recommendation is made in view of the strong tendency of a wideband amplifier to pick up power supply hum from a nearby unit. Extraneous hum voltages will introduce error in voltage measurements.

Any small power supply will be satisfactory which is capable of delivering well-filtered and regulated d. c. at 250 volts and 50 milliamperes, and 6.3 volts at 1 ampere. Most experimenters already own a suitable power supply or have sufficient idle parts to build such a unit.

The power supply should be kept as far away from the amplifier as possible. However, it may be placed inside a cabinet with the amplifier, provided a large enough cabinet is used to allow at least a 6-inch separation between power unit and amplifier. It will be advisable also to mount a heavy steel shield between the power supply and amplifier and to provide adequate louvres or holes for good circulation of air.

Adjustment

After the wiring has been checked and verified, proceed with the initial adjustment according to the following instructions.

(1) Connect the amplifier to its power supply and switch-on the power.

(2) Connect an a. c. vacuum-tube voltmeter to the output jack, J_2, and set the meter to its 0-100-volt range.

(3) Connect an accurately-known 1/10-volt a. c. source to the input jack, J_1. This input voltage may have any frequency between 60 cycles and 4 megacycles.

(4) Adjust gain control R_2 to give a reading of exactly 50 volts on the vacuum-tube voltmeter. At this point, the gain of the amplifier will be exactly 500. Mark this setting of the gain control as **X 500.**

(5) Adjust gain control R_2 to give a meter reading of 10 volts with the same 0.1-volt input. Switch the meter to its 0-10-volt range for closer reading. The gain of the amplifier at this point will be 100. Mark this setting of the gain control as **X 100.**

(6) Adjust gain control R_2 to give a meter reading of 1 volt with the same 0.1-volt input. Switch the meter to its lowest appropriate range for closer reading. The gain of the amplifier at this point will be 10. Mark this setting of the gain control as **X 10.**

Using the Amplifier

To make low-voltage measurements, connect the amplifier, a. c. vacuum-tube voltmeter, and test leads, as shown in Figure 3. Connect the test leads, to the source of unknown voltage and note the meter reading. Set the meter to its lowest appropriate range, for close reading. If the gain control is set to **X 500,** multiply the meter reading by 0.002 to obtain the unknown voltage value. Mutiply by 0.01 when the gain control is set to **X 100,** and by 0.1 when the gain control is set to **X 10.** Thus, a meter read-

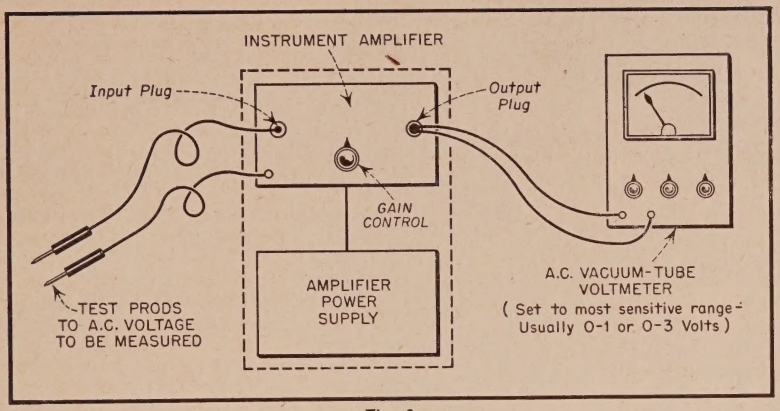
INSTRUMENT AMPLIFIER
Input Plug
Output Plug
GAIN CONTROL
AMPLIFIER POWER SUPPLY
TEST PRODS TO A.C. VOLTAGE TO BE MEASURED
A.C. VACUUM-TUBE VOLTMETER
(Set to most sensitive range - Usually 0-1 or 0-3 Volts)

Fig. 3.

ing of 2½ volts will indicate 0.005 v. (or 5 millivolts) when the gain control is set to X 500. This same 2½-volt meter reading will indicate 25 millivolts when the gain control is set to X 100, and will indicate ¼ volt (or 250 millivolts) when the gain control is set to X 10.

Do not attempt measurements with this amplifier at frequencies lower than 50 cycles nor higher than 4 megacycles. It is advisable to use shielded test leads between the signal source and the amplifier input and to remove the hands from the leads during a measurement. When making radio-frequency measurements, keep leads between the signal source and amplifier as short as possible.

The input coupling capacitor, C_1, will protect the amplifier against any d. c. component which may be present in the a. c. source under test (an example would be when measurements are made at a tube plate circuit). However, do not exceed the 400-volt maximum rating of this capacitor. If higher d. c. voltages are expected, replace capacitor C_1 with a 600-volt unit.

C_1—0.1 ufd. 400-volt tubular
C_2—20 ufd. miniature silvered mica
C_3—25 ufd. 25 d. c. w. v. midget tubular electrolytic
C_4—20 ufd. 450 d. c. w. v. midget tubular electrolytic
C_5—0.1 ufd. 400-volt tubular
C_6—25 ufd. 25 d. c. w. v. midget tubular electrolytic
C_7—20 ufd. 450 d. c. w. v. midget tubular electrolytic
C_8—0.1 ufd. 400-volt tubular
C_9—25 ufd. 25 d. c. w. v. midget tubular electrolytic
C_{10}—0.1 ufd. 400-volt tubular
C_{11}—20 ufd. 450 d. c. w. v. midget tubular electrolytic
J_1—Female coaxial chassis jack
J_2—Miniature open-circuit phone plug
L_1, L_2, L_3—24 microhenries (See text for winding instructions).
R_1—1 megohm 1-watt carbon
R_2—75-ohm wirewound potentiometer
R_3—1800 ohms 1-watt carbon
R_4—5000 ohms 1-watt carbon
R_5—1 megohm 1-watt carbon
R_6—56 ohms 1-watt carbon
R_7—1800 ohms 1-watt carbon
R_8—5000 ohms 1-watt carbon
R_9—1 megohm 1-watt carbon
R_{10}—56 ohms 1-watt carbon
R_{11}—1800 ohms 1-watt carbon
R_{12}—5000 ohms 1-watt carbon

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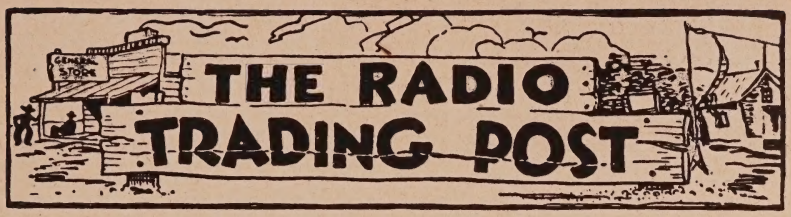

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FOR SALE—Fluorescent "Radio Service" signs, interchangeable panels, 3" letters, $14.95. A. C. Hart, 4848 Linden Ave., Hammond, Ind.

FOR SALE—FM-Rider, $1; Mathematics for Elect., Radiomen, Cooke, $3; Elements of Elect., Timbie, $2; Fund. of Radio, Terman, $2; 100 kc precision crystal, RCA VC-5-M, $4. L. F. Hetchler, 428 University Village, Minneapolis, Minn.

FOR SALE—(Pilot) FM Pilotuner, for first $15 or good used auto radio. G. A. Siragusa, 1704 Van Buren St., Bronx 60, N. Y.

SELL OR TRADE—Power Pack 110 V.D.C. in, 600 V.D.C. at 1 amp. out, $35; Dremel Moto-tool No. 2, $15; 1000 misc. new radio parts. Want N.C. 57-M. Simon Dresner, 322 W. 72 St., New York 23, N. Y.

WANT—Home type power wood working equip. such as bench saw, drill, lathe, jointer planer, jig saw, etc., or a complete wood working shop. Will pay cash or swap radio gear. M. V. Ratynski, 86 George St., South River, N. J.

FOR SALE—12.5" T64 Hallicrafters TV custom chassis complete with G.E. picture tube, excell. cond., uses 10 or 12" tube, $120, express prepaid within 500 miles. C. W. Cassel, RD 4, Irwin, Pa.

FOR SALE—Sam's Fotofacts 1-52, 75c each, in envelopes, no binders. Will trade for radio equipment. V. B. Morrison, 5007 Capitol Ave., Dallas 6, Tex.

FOR SALE—Riders manuals 3-12, abridged 1-3. Best offer takes. L. T. Ullrich, 4629½ Melbourne Ave., Los Angeles 27, Calif.

WANT—Nash 1948 custom radio. Marvin Sims, 1724 South 13, Lawton, Okla.

FOR SALE—25 asstd. tubes, $1; 100 carbon and wirewound resistors, $1; double-button mike, $1; set tester, $5; 14" dynamics, $5 each. Minimum order, $3. No C.O.D.'s. Radiomart, 406 E. Acacia, Glendale 5, Calif.

WANT—Sig. gen., tube tester, VOM and other radio and TV service equipment. Will pay cash or swap for ham equipment. W. R. Percival, 32 Kenmore Ave., Newark 6, N. J.

FOR SALE—Rider manuals, Rider chanalyst model 162-C, Precision counter model 10-20 C tube checker, Stancor 6v. power pack. Write for prices. J. J. Levine, 15-17 Kelley Sq., Worcester 4, Mass.

WANT—Press camera with flash syncronized shutter; 6.3 lens or better and from 1 sec. to 150 or 2000 of second, one that takes 3 1/4 x 4 1/4 or larger. Have TV, amplifiers, radios to trade. John Arnold, P.O.B. 84, Bluffs 3, Ill.

WANT—Hammarlund SP400X, must be in perfect cond. State lowest price in first letter. Need Cardwell BC211 with original charts, xtal or LM meter. Conn Borysevich, 1066 President St., Brooklyn 25, N. Y.

FOR SALE—5 complete Link Police Mobile Stations, 30-40 MC. A. M. Everything from handset to spring mount whip, 15 watts output, $50 each. R. Hayos, 219 W. 81st St., New York, N. Y.

SWAP—Model 9Y-3 band Motorola, good cond., 9 tubes, no cabinet. Want tube tester. State condition. L. E. Rishty, 2162-76 St., Brooklyn 14, N. Y.

WANT—1946 edition of "The Radio Amateur's Handbook." State price, condition. All inquiries answered. Wayne Carlson, 205 W. Mechanic St., Harrisonville, Mo.

FOR SALE—Jackson vacuum tube tester, model 436 complete with all test charts, excell. cond., cash or trade for sig. gen. to cover VHF or All-channel TV booster. C. R. McLaughlin, 801 Kingston Rd., Baltimore 12, Md.

WANT—Short wave receiver such as Hallicrafter, National, etc. Send details and price. H. Latko, 1922 Dickens, Chicago, Ill.

FOR SALE—NRI electronic multitester completely assembled with A. C. Head, 1,000,000 ohms per volt sensitivity, with operating instructions. Make offer. W. R. Oldham, RFD 1, Box 100, Ashland, Ky.

FOR SALE—Send for list of units for KW transmitter, 274N transmitters and receivers, PE103, beam prop pitch motor, lathe, radio parts. Oscar Floy, Thornton, Iowa

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WANT — Model 190 Fada model chassis with good first, second I.F. coils. For Sale. model 3212 Triplett radio tube tester, 32 v. motor of 1/4 h.p., both good cond. E. Kiehnhoff Radio Service, Box 355, Wathena, Kan.

FOR SALE—Supreme 504-B, Feiler TS-3 Stethoscope, 2 complete Appliance Service Courses, few tubes, 9 sets Photofact folders, books, etc., $200. Raymond Winters, Box 1, Howard, Colo.

FOR SALE—Edwards FM Fidele tuner, $15; Silvertone radio-phono, $35; Silvertone pushbutton auto radio, $25; 7EP4 CRT, $10, never used. George Dunseath, 2131 Clinton Ave., Bronx, N. Y.

WANT—Tape or wire recorder. State condition, model, make. Alvin Lundquist, 2164 Wellsley Ave., St. Paul 5, Minn.

WANTED—Crystal microphone with phone tips, must be in good condition. State type, price. Francis Dixon, 130 Spruce St., Minersville 4, Pa.

SWAP—Webster record player, model 60; R. M. A. 375. 21/4 x 31/4 Graphlex F. 4.5 Anastigmat lens, revolving back with film pack adapter, like new. Trade for TV. W. L. Caywood, Box 96, c/o F. N. Products, Springfield, Ohio

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FOR SALE—NRI model 67 tube tester, $40; NRI model 33 sig. tracer, $45; NRI model 88 sig. gen., $35; all like new, all 3 for $115. NRI service manual, like new, $10. J. Leonard Ochs, RD 1, Parkers Landing, Pa.

FOR SALE—Hickok model 534 tube, set tester, like new, $100; Feiler sig. tracer, model TS-3, like new, $20; Simpson Multimeter, model 240, used, $14. W. A. Lough, 18 Centennial St., Frostburg, Md.

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SELL OR SWAP—G.E. 1201d new speaker; phonoscillators; Webster No. 56 record changers; TV tuner, antenna; used radios; etc. Want Sams 1-4, Riders 18, 19, 1-5. Val Sanford, 71 W. 104 St., New York 25, N. Y.

SELL OR TRADE—G.E. JFM-90 FM tuner, 42-50mc., 9 tubes, like new, double conversion, double limiters, cost $60, service manual included, $25. Want wire or tape recorder foundation unit. Phil Mooney, South Hero, Vt.

FOR SALE—Extra long distance crystal set, uses IN34 fixed crystal, in kit form with diagram, instructions. Complete kit, less headphones, antenna, wire, solder, $4.85. Daniel Seidler, 4825 So. Wolcott St., Chicago 9, Ill.

WANT—60 cycle A.C. operated receiver covering marine frequencies 500 kc to 110 kc. Also, receiver covering 80-40-20 amateur bands without broadcast band, 60 cycle A. C. operated. R. G. Summers, 104 Herman St., Buffalo 12, N. Y.

SWAP—BC-186 receiver, BC-187 xmtr., BC-188 modulator, 2400-3700 kc.; Hickok capacity tester, $15; Hickok tube tester, $25; 15" dynamics, $15, 5 for $70, etc. Knight, 1000 S. Glendale Ave., Glendale 5, Calif.

FOR SALE—Jackson 640 sig. gen., $35; Silver Vomax 900 VTVM, $30; 38 Photofact folders, $38; new tubes, resistors, etc. (50% off list) or trade for P. A. system plus cash. Harold Melle, 1020 Wright Ave., Toledo 9, Ohio

FOR SALE—Radio Troubleshooter's Handbook by Ghirardi, $3.50; Modern Radio Servicing, $3.50; Burgess Vibro-tool, $3.50. J. C. Luttrell, 729 West St., Jax, Fla.

WANT—Used Seeburg or Wurlitzer automatic record changer, amplifier without cabinet. Must be good cond. Salvatore Leto, 74 Columbia Rd., Arlington, Mass.

SELL OR TRADE—Waterwitch outboard motor, S-38 Hallicrafter receiver for National N. C. 57 receiver or N. C. 46. E. C. Whitaker, 814 Whitelock St., Baltimore 17, Md.

WANT—Used radios, refrigerators, sewing machines, radio books, guns, rifles, adding machines, stoves, chinaware, typewriters, etc. buy anywhere, pay postage on every item. E. C. Snyder, Pitman, Pa.

FOR SALE—Triplett emission type tube tester, $25; 5000 ohms-per-volt VOM tester, $14. Both excell. cond. W. Siuta, 4011 Lawndale St., Detroit, Mich.

SELL OR SWAP—Syncro scope, AN34TS. Need enclosed rack, no greater than 6' high. Similar to Parr-met ER205 F. B. R. H. Saunders, 12 School St., Salem, Mass.

WANT—Late model Solar CF-1-60 Exam-Eter. State age, condition, price. Martin Radio Service, 200 Pennsylvania St., Peoria, Ill.

WANT—Schematic for BC-455-B radio receiver. Give value of components. C. C. Howenstine, 19374 Carman Ave., Detroit 3, Mich.

FOR SALE—18 tube TV chassis with 10" picture tube. Best offer. Philco TV booster, $10; 6 4-prong plug in coils for S. W. and B. C., $2.75. Warren Thomas, 10 E. 12th St., Tyrone, Pa.

FOR TRADE—Westinghouse O-150 v. AC meter, 7" dia. Switchboard type SM. Want FM tuner or parts. D. L. Roberts, 609 E. Mo. St., Kirksville, Mo.

SWAP—BC-AO-430 xmitter with 2 control boxes, 2 coils and dynamotor. Want small tube tester, sig. tracer, or 1, 2, or 3 in scope. Billie Overton, Box 185, Beaver, Okla.

SWAP OR SELL—Radio parts, meters, auto clocks (some perfect), 120 folding camera with tripod, tools, perfect soldering irons, mail order course, etc. L. J. Lantosh, 472 Bostwick Ave., Bridgeport, 5 Conn.

SELL OR SWAP—First edition books, history, autobiography, etc., back dated magazines. Want Hallicrafters model S-38A or similar. J. S. Chunin, P.O. Box 241, Benzonia, Mich.

SELL OR TRADE—Complete (less experiment kits) NRI Radio Course. Best offer. Remington electric shaver. Want table model AM-FM radio, small electric tools, etc. Ralps Walker, Rt. 2, Taylorsville, N. C.

TRADE—Mdl. 650 Superior sig. gen., Firestone 3 h. p. outboard motor, 12 ga. Western Field pump shotgun used 1 yr. All items in excell. cond. Need Sprague Teleohmike, Sam's, Riders. H. F. Erfman, Jr., Howard, S. D.

FOR SALE—Riders manuals, 1-9, excell. cond., $40 prepaid in U. S.; odd lot tubes 65% off list. Send for list. Ellis Radio Service, 421 Grand St., Vermilion, Ohio

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FOR SALE—Sig. gen., sig. tracer, volt-ohm-milliameter, tube checker, oscilloscope, all in A-1 condition.; Rider's manuals 6-19 (like new), tubes, parts. Harry's Radio Repair Shop, Box 256, Clinton, Ark.

FOR SALE—BC-412 oscilloscope, excellent condition. SX28 receiver in fair condition. Best cash offer. S. B. Ehrlich, 267 E. Paces Ferry Rd., N. E., Atlanta 5, Ga.

SELL OR TRADE—NRI communications and TV correspondence course, complete, in good condition. Want test equipment or $60 or what have you. R. L. Coy, P.O. Box 245, Waukegan, Ill.

WANT—SX28, a receiver like new. Cash or swap. Have Triumph 830 oscillograph-wobbulator, Vomax 900 VTVM, both as new; 300 w. AC gas generator, new; RCA chanalyst, others. W. H. Pendleton, 14 Brookdale Rd., Arlington 74, Mass.

FOR SALE—Superior tube tester, volt-ohm meter 600, RCP 710 A. M. pocket sig. gen., E. M. C. 101B volt-ohm meter, all in perfect cond., Superior 670 ohm-volt meter (like new). Emanuel Siletchnik, 4708 Church Ave., Brooklyn 3, N. Y.

WANT—RCA chanalyst, C-D Analyzer such as BF-50, TV sig. gen, and 5" scope. Must be in working cond., priced right. Have parts, etc., to trade. H. T. Huff, Box 192, Leesburg, Ohio

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FOR SALE—Like new Dumont 274 scope, original carton; Supreme sig. gen. No. 561, used very little. Make offer. Ed Kane, Soldiers Home, Quincy, Ill.

FOR SALE—BC457 transmitter, $5; 500 v. supply, $7; 7" TV receiver, all tubes except C. R. tube, $30 as is; RCP 322 tube tester, $20. George Whitten, Box 115, Ft. Wayne, Ind.

FOR SALE—Shure Dynamic microphone No. D6243, $35.50. Cote's Radio Service, 1404 Townsend, Detroit 14, Mich.

WANT — Complete or partly dismantled BC 348 O receiver for parts. Will swap Test-Rite sig. gen., model B-45 for Heathkit VTVM kit, complete, preferably unassembled. O. C. Vidden, Fertile, Minn.

SWAP—Edwards FM tuner, used as demonstrator only, for small Hallicrafter (must use power transformer). Also have RMS all channel TV booster. Mac Rabie's Radio Shop, Franklin, N. Y.

FOR SALE—Sam's Photofacts 1-90 with leather binders, Hickok model 209 volt-ohm-capacity-milliammeter. S. A. Hotlestod, Bancroft, Iowa

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WANT—Complete manual for APN4 receiver, scope indicator; back issues of Radio Electronic Engineering (before Nov., 1948), QST (before March, 1947, after Feb., 1949), Radio Craft (before Oct., 1948). C. Vaillancourt, Jr., 57 Begin Ave., Levis, P. Q., Canada

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SELL OR SWAP—Best offer, Riders manuals 1-8, Hickok model OS-10 test osc., 2-804 tubes, 1-Rk20. Chester Carter, Richmond, Mo.

FOR SALE—Riders manuals 1-5 abridged, 6-13, $90, excell. cond.; 2 W. E. sound powered mikes 150885, 40' cable, $20; model 400 B Supreme instrument tray, etc. Jack Johnson, 46 Weldon St., Rochester 11, N. Y.

FOR SALE—Up-to-date C. R. E. I. TV engineering course, complete, $25. J. P. Claybourne, 48 Avenel St., Avenel, N. J.

FOR SALE—Prop pitch motor completely converted, ready for use with multitap transformer, spare motor, like new, $20 for everything. Jos. Endlich, 67 Sayers Ave., Lansdowne, Pa.

FOR SALE—Riders manuals 1-7, good condition; 12" Technocroft overhead lathe with magnetic cutter. Make offer! Murrell Long, P.O. Box 962, Delano, Calif.

FOR SALE—Radio City model 447 V. O. M. like new with prods, batteries. Best offer takes it. Don Gillespie, 5003 Fenton Rd., Flint, Mich.

FOR SALE—TV 12" Transvision. 12½ to 15" tube can replace tube now in with no changes in circuit. Output indicating meter and transformers. L. J. Lo Nigro, 52 Willowdale Ave., Montclair, N. J.

FOR SALE—288X Hickok generator; Sylvania tube tester, polymeter, 7" scope, LF Solar Exameter. All in excell. shape. Best offer over 60% of present net value for lot. Little more separately. R. Weil, 80 West St., Albany 5, N. Y.

FOR SALE—Receiver BC 312-N with a/c power supply, $50. Freq. meter BC-221 AH with a/c power supply, $50. Link receiver-transmitter 695-B, $35. Carver TV Service, 1748 E. 177 St., Bronx 60, N. Y.

FOR SALE OR SWAP—Towards an electric hand drill: used tubes from German radio, Philips miniwatt ECH 4, 89; Philips miniwatt AZ1, 90; Telefunken Milano WE 13; Wilcox CW 3 receiver manual. Ray Bohnert, Medford, Wis.

SELL OR TRADE—R. C. P. 802N tube, set tester, Heathkit sig. gen., Triplett 25,000 ohms/v. multimeter. Want good power bench saw and handtools, etc. Harold Kuhs, Cattaraugus, N. Y.

SELL OR TRADE—McMurdo Silver Masterpiece 1V all-wave receiver, Hammarlund Comet Pro communication shortwave receiver, other items. Want testing equip., 3-speed record changer, TV, etc. Glenn Watt, Chanute, Kans.

SELL OR TRADE—BC-375, all tuning units, dynamotor, etc., new. Want power supply for BC-459. B. A. Schmidt, St. Meinrad's Abbey, St. Meinrad, Ind.

FOR SALE — Webster-Chicago wire recorder foundation mechanism, with RF coil, new head, instructions on how to build high fidelity wire recorder. Best offer. Bill Barber, 353 Mass. Ave., Cambridge, Mass.

WANT—Hickok model 288X or Jackson model 641 sig. gen. and Hallicrafters S-38 or S-38A receiver. Must be good cond. J. T. Cookson, Puxico, Mo.

SWAP—Pocket sig. gen., new, and Marlin 81DL Hi Power .22 with 6X Weaver scope and sling, new. Want 12½" TV chassis or Revere projector. R. A. Misak, 2147 W. Dickens Ave., Chicago 47, Ill.

FOR SALE—15" Dynamic speaker, 16 ohm voice coil, 12,500 ohm field coil, $6. Speaker like new, never used. C. A. Kusak, 111 Hirschbeck St., Buffalo 12, N. Y.

FOR SALE — Complete NRI radio, TV course. 7 kits includ. all parts to build, test, experiment with different circuits. Excell. cond. Make offer. George Bobik, P.O. Box 441, Monongahela, Pa.

SELL OR SWAP—Ranger model 118 Aircraft Marine receiver for 115 v. a/c, battery operation, covers 200 kc to 400 kc, 550 kc to 1520 kc. Phono jack. $45. Need S-38 or S40A Hallicrafter receiver. Ed Drozdowski, 23 Fowler St., Lackawanna, N. Y.

WANT—Jackson model 641-A or G. E. model YGS-3 sig. gen. with manuals, charts. Give lowest price, condition. Daves Radio Shop, 1316 42 St., Brooklyn 19, N. Y.

WANT—On a swap basis: Gonset converter, either 3-30 mc or 28-30 mc. Marc Molyneux, Jr., 53 Gulf St., Chickasaw, Ala.

WANT—SX28-A, any condition. Also sweep generator with xtal markers. J. J. Jordan, 74 Richelieu Terrace, Newark 6, N. J.

SELL OR SWAP—2 Neon transformers, SW2 electric set, small amplifier, VTVM less battery, condenser checker, vibrators, 3 meters, etc. Need communications set. T. R. Rohland, RD 2, Box 334, Huntingdon, Pa.

FOR SALE—NRI radio, TV correspondence course (2/3 never used) with equipment, testers. Will consider offers. Beverly Jane Welsh, 112 New St., Staten Island 2, N.Y.

FOR SALE—Riders manuals 1-4, very good condition, $35 for the lot or $10 separately. E. A. Denby, 1906 Stone St., Port Huron, Mich.

WANT—Old model table radios in working condition. Write, stating make, price and model. Al Beavin, Fair Haven, Vt.

WANT—Remote control unit MR-1B for Bendix receiver RA-1B and MR-38A shock mounting. Also APR-4 receiver or tuning units. A. R. Bowman, 420 N. 4th St., Albuquerque, N. M.

WANT—RCA Magic Wave transformers 9849, 9814, 9813. Will pay net, plus 15% for postage. Move that obsolete stock now. Norwest Radio Laboratories, Shelby, Mont.

WANT—Tube chart, instruction book for Supreme tube tester, model 400, made by Supreme Instrument Corp., Greenwood, Miss. Ottis Hudson, 9217 Oels, Ft. Worth, Tex.

FOR SALE—Late model Sylvania portable tube tester with rack for use on counter. Excell. cond. Sacrifice, $50, F.O.B. Wisconsin. Wallin Radio & TV, Williams Bay, Wis.

FOR SALE—Riders Radio Trouble-Shooter's manuals 1-12, complete index, $50. J. N. Cheadle, Elect. Engineering Dept., S. D. State College, Brookings, S. D.

WANT—Tube tester chart for Million Tube Tester model "DD". Million amplifier model 4020 schematic wanted. Also instruction pamphlet or data on these two items. Thos. Bianco, 542 47 Ave., San Francisco 21, Calif.

POSITION WANTED—Holder of first class radio telephone operators license desires position anywhere in U. S. Initial salary secondary. G. L. Davenport, Gen. Del., Chadron, Neb.

FOR SALE—Sylvania tube checker, type 140; Blilay crystal controlled oscillator, model 1A; Superior multimeter, model 770; Riders 1-5 abridged 6, 7, 10, 14, 15. $160 for everything. Excell. cond. John Longlusci, RD 1, Wyoming, N. Y.

WANT TO BUY—Late Riders manuals. Write immediately stating condition. Chauncey Coston, Rt 3, Box 35, Hoquiam, Wash.

WANT—R. C. A. coin operated radios, new or used. Edward Janczewski, 136 Spring St., Middletown, Pa.

FOR SALE—Radio service shop. Small appliance and electrical supplies. Blount Radio Service, 203 W. Main, Chanute, Kan.

FOR TRADE—1 pair Nippon 8 x 30 army binoculars with case. Want 110 v. a/c to 6 v. d/c power supply. Luther Toler, Clear Fork, W. Va.

WANT—C-D battery eliminator model 110-BA12, Riders 18, 19. Will trade Twin-Trax tape recorder chassis, like new. Also Corona portable typewriter. What have you? Luther Cansler, Kings Mountain, N. C.

FOR SALE—Riders 1-5, 10, 12, $8 ea.; Supreme 1-5, $1 ea.; Sams folders 1-46, $1 ea.; RCA 1-2, $4 ea.; G. E. 39-42, $2; Zenith 1-2, $3. Alfred Biles, 2477 Lombard St., San Francisco 23, Calif.

SELL OR TRADE—E-200 Precision sig. gen. in new cond., $35, or trade for typewriter in good cond. John Bakke, Rt 1, Box 51A, Oklee, Minn.

FOR SALE—Radio, record business with good volume of exclusive business in town of 10,000 people. Established over 10 yrs. Morris Kelly, Belton, Tex.

WANT—Complete instruction book for RME Communications receiver, model 70 (69) as issued by company. L. C. Chapman, Rt. 1, Fairhope, Ala. (Baldwin Co.)

SWAP—Stevens .22 cal. used 6 shot slide action rifle, fair; accurate, for reputable TV booster. Archie Pinquite, Jr., 511 S. Fifth, Marshalltown, Iowa

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SELL OR SWAP—CREI correspond. course sect. 1, "Introduction to Practical Radio Engineering." G. F. Marts, 2847 S. 3rd St., St. Louis 18, Mo.

FOR SALE—Webster Chicago wire recorder, model 78, perfect cond., five ½ hour spools, crystal mike, $60. C. Schroder, 72-15 65th Pl., Glendale 27, L.I., N.Y.

WANT—Supreme Service manuals in good condition. Also V.O.M.. Advise price, cond. H. Heabler, 12265 Washburn Ave., Detroit 4, Mich.

FOR SALE—Test Rite model B-45 batt. sig. gen.; C-D Decade capacitor model CDB, Precision Series 8325 volt-ohm-meter, Superior model 450 tube tester, etc. J. G. Barrett, 68 Bidwell Ave., Jersey City 5, N. J.

SELL OR TRADE—R. C. P. sig. gen. model 705 with test leads and instructions, $25. G. H. Swiska, 109 E. School St., Woonsocket, R. I.

SELL OR TRADE—G.E. set tester model UM-3, all ranges, 2000 ohms per volt, good cond., first $20 or trade for other test equipment in good working order. Howard Barr, 211 Governor St., Paterson 1, N. J.

FOR SALE—Riders service manuals 1-7, excell. cond., $9.95 ea., Gernsback No. 4 Service manual, 1.95; Supreme radio service course, $1.50; etc. Want Army-Navy surplus. Alfred Livingstone, 12-01 Ellis Ave., Fair Lawn, N. J.

WANT—Sig. gen., tube checker, in good condition. New York City area. Send make, model, number, price. Paul Taras, 326 E. 155 St., New York 51, N. Y.

TRADE—Like new $20 3-way portable radio, like new Ultra mike and batteries, table model less cabinet, Philco car radio aerial, etc., for typewriter. Ronald Hileman, 560 E. 3rd, Bloomsburg, Pa.

SELL OR SWAP—Model 80 Webster wire recorder, excell. cond., 5 spools of wire in various lengths. Offer or swap for AM-FM tuner, Armstrong circuit preferred. Ask $95. J. A. Felt, 20 Vinton Rd., Madison, N. J.

SWAP—9" Dynamic speaker with transformer, without cabinet, heavy duty, good for P. A. Want two P.M. 4" speakers, with transformers, even if from P.E. 157 Army power boxes. J. G. Gow, 1380 Putnam Ave., Brooklyn 21, N. Y.

FOR SALE—Closing radio repair department. Entire stock of parts, Riders manuals (two sets), test equipment must be sold. Write for list. Hodge Appliances & Furniture, Inc., 199 S. Main St., Liberty, N. Y.

FOR SALE—Webster wire recorders, model 80, Crosley radio, phon. combin.; washing machine plastic covers, or swap for new washing mach., ironers, or dryers or parts for same. Electric Service Co., 14 Brookline St., Cambridge, Mass.

SWAP—Patterson PR-16 16-tube communications rcvr.; 18-tube Midwest, up to 65 megacycles; Triplett VOM, $5; Triplett sig. gen., $15, etc. Want 18" dynamics, Riders, G. F. Knight, 1000 S. Glendale Ave., Glendale 5, Calif.

WANT—McMurdo Silver transmitter, 75w. C.W., 30w. phone. Write G. W. Shaffer, 132 Franklin Ave., Brookville, Pa.

FOR SALE—RCA type 630 cabinets, $15; 10BP4 CRT's, $10, Horz flyback transformers 211T1, $1.75 and deflection yokes 201D1, $2. Material used but like new. 90-day guarantee. Andrew Hogh, 94 W. Tremont Ave., Bronx 53, N. Y.

FOR SALE—Instrument condenser tester, tube tester, only $32. M. S. Valentic Box 144, Masontown, Pa.

SWAP—I will print your radio repair tags, envelopes, letterheads, etc., for a good recorder or what have you? Arthur Jenia, Jenia Bros. Electric Co., Virginia, Minn.

FOR SALE—Riders, equipment, tubes and speakers at Rock Bottom prices. Write for prices. Beneh's Radio Service, 4922 Franklin Rd., Boise, Idaho

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FOR SALE—Garod Personal portable, demonstration model, like new without a scratch. List $32.50, special at $18, with batts. Cannot be told from new! Bruce Radio Co., 1171 Union St., Manchester, N. H.

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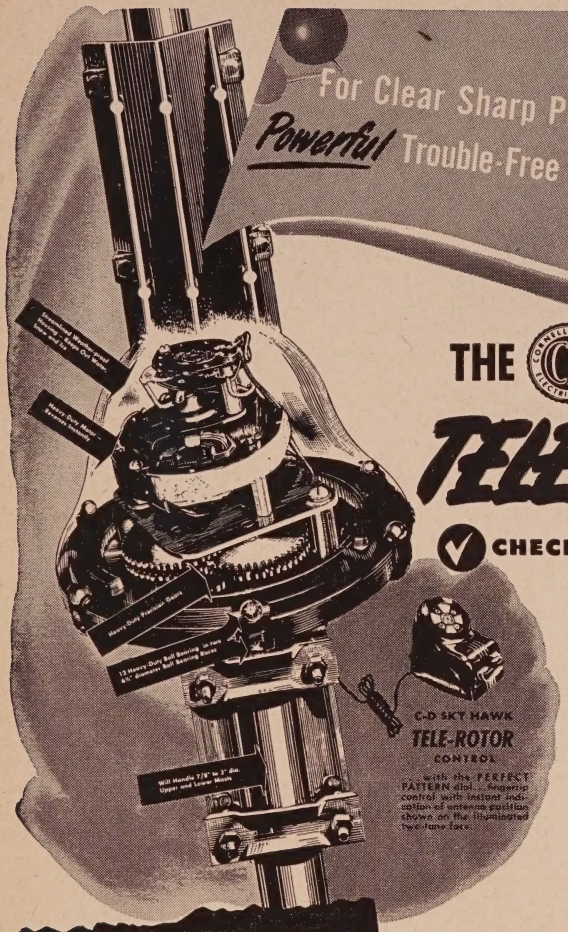
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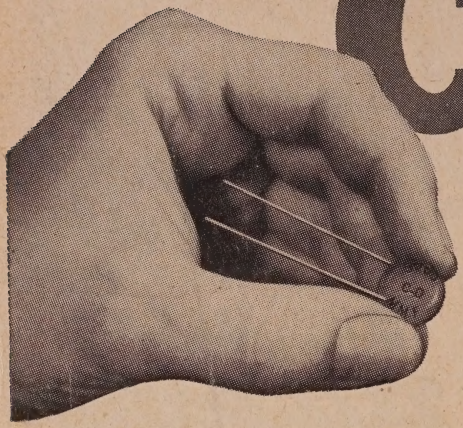

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